Methodological note: Trend-cycle decomposition

A trend-cycle decomposition method aims at further decomposing seasonally adjusted data into a trend component and a cyclical component (expressed as deviation from the trend). Identifying and estimating the trend and cyclical components of key economic indicators is very relevant: the trend provides information on longer-term movements in the seasonally adjusted series over several years; the cycle is a sequence of smoother fluctuations around the longer-term trend in part characterised by alternating periods of expansion and contraction.

There are many alternative methods to identify and estimate the trend and cycle components in time series. The estimates for three indicators — GDP, industrial production, and employment — are produced using three different filters:

Hodrick-Prescott (HP): a filter widely used in macroeconomics to fit a smooth curve through a set of points.

Christiano-Fitzgerald (CF): a well-known approximation to an ideal band pass filter, estimated non-parametrically.

Unobserved Components (UC): a parametric approach which involves estimating a statistical model and decomposing the series into components, including the trend and cycle; since July 2022 the statistical model used is the one proposed by Harvey and Trimbour with the cycle generated by two harmonics.

Since seasonally adjusted data also include an irregular component, it is important how this component is treated in trend-cycle decomposition methods. So called de-trending methods, such as the HP filter, decompose the series as a sum of a trend and a cyclical component. In this case, the cycle also contains the irregular component. Cycle extraction methods, such as the CF filter, first extract the cyclical component within a pre-specified band of frequencies and then estimate the trend as the difference between the original series and the cycle component. In this case, the trend also contains the irregular component. Finally, the UC model estimates simultaneously the trend, the cycle and the irregular components, under some hypotheses, so that neither the trend nor the cycle contain the irregular component. A good understanding of the various components stemming from trend-cycle decomposition methods is essential, especially in the presence of outliers at the end of the time series. In fact, different types of outliers affect different components: additive outliers typically affect the irregular component so that they will be visible in the HP filtered cycle and in the CF filtered trend and not in the trend or cycle components obtained by the UC approach. Finally, other types of outliers such as a level shift or a ramp effect will typically impact the trend. A ramp effect is a smooth, linear transition between two time points unlike the abrupt change associated with a level shift. Understanding the nature of an outlier can require several time series points.